PAEDIATRIC COCHLEAR IMPLANTATION

The normal development of hearing and speech is dependant upon development of the brain. It is this development that cochlear implantation essentially addresses.

The hearing section of the brain undergoes substantial development of its size, connections and organisation during the first two years of life. This development is dependant upon auditory stimulus from the ear. If this stimulus fails, the hearing area remains under-developed.

There is thus a compelling impetus to implant the profoundly deaf child as early as practical, preferably in both ears. Many surgeons will endeavour to operate, perhaps bilaterally, at six months, if there are no contraindications to surgery at this age.

If one ear is deaf, the better ear can largely stimulate the brain, but the ability of the deaf ear to respond to a cochlear implant will gradually reduce with time.

Presentation:

Deafness in children may occur in isolation, or may be a result of more generalised medical problems. The task for the clinicians is to identify the overall spectrum of conditions, their pathological manifestations, and the implications for successful surgery.

Investigation:

Audiology, radiology and other medical tests are used. In addition, other medical specialists, psychologists and possibly social workers may be involved.

Prognostication:

It is important for the team to accurately assess the child's prognosis. Successful implantation may be defined as the outcome having met or exceeded the family's reasonable expectations, fully counselled to them before surgery, and the surgical process being performed to their satisfaction. Thus, the prognostication is the key, as this sets both the team's and the family's expectations.

To achieve this, the team must be aware of any potential threats. Currently, cochlear implantation has matured such that the procedure is normally successful unless adverse incidents intrude to prevent this. Most such influences can be anticipated before surgery and therefore should be identified as to their physical location, their likelihood of effect, and the severity of impact on the child's ability.

The cumulative concerns are assessed in order to accurately counsel the family.

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Surgery:

Implant surgeryis now refined to the point that in expert hands a bilateral implantation on a six month old infant is a safe procedure. The optimal surgery employs a small incision on the rear of the ear itself, such that parental distress is minimal, and the effect on the child limited.

The implant body is sited under the skin, with the electrodes passing into the cochlea, the surgery lasting 30 minutes in routine cases.

In a minority of cases, useful hearing in the lower frequencies may remain, prior to surgery. In these instances, hybrid devices are employed. Finer electrode arrays seek to preserve hearing, and postoperatively the implant stimulus is combined with conventional hearing aiding to provide a fuller auditory experience.

Postoperatively, a head bandage is applied for a week to enhance implant stability.

Habilitation:

In children, the impetus is to develop listening, speech and language in line with that of the normally hearing child.

Habilitation may involve auditory-verbal techniques where the family input is the key to the child's development of listening, hearing, and speech production. This relies heavily on a motivated family. Auditory-oral methods include visual cues. Signing techniques (hand gesture communication) are useful, but are now superseded by the first two methods, that provide the best social communication skills in mainstream society.

Complications:

Surgical problems are now fortunately limited, due to the refinement of technique. The main surgical difficulties relate to a malformed or previously diseased cochlea; these are usually detected preoperatively and the family warned accordingly.

Subsequent problems remain a risk. Family difficulties or other problems may remain undetected until after the event. Long term electronic problems or trauma to the implant may also occur.

Unilateral Cochlear Implantation:

Implantation is now readily considered for the child with unilateral deafness, as children adapt well to the procedure. The child with a unilateral loss is more handicapped than previously realised, socially, during schooling, and later, economically. Implantation is therefore now recognised as optimal management. Management is much the same as for bilateral cases, but with generally more rapid and reliable longer term progress, given the better auditory experience by virtue of the unaffected ear. Lesser effectiveness remains a concern for those children considered later in life for these unilateral procedures.